Claims

1. A method, comprising:

exposing a surface region of a layer of a first material having a first chemical composition to at least one ion beam in an environment comprising a reactive species to texture the surface region of the layer and to change the composition of the layer in the surface region to a second material having a second chemical composition different than the first chemical composition.

2. The method of claim 1, wherein the at least one ion beam is two ion beams.

3. The method of claim 1, wherein the at least one ion beam is three ion beams.

4. The method of claim 1, wherein the at least one ion beam is four ion beams.

5. The method of claim 1, wherein the at least one ion beam comprises at least five ion beams.

6. The method of claim 1, wherein the reactive species comprises oxygen.

7. The method of claim 1, wherein the reactive species comprises nitrogen.

8. The method of claim 1, wherein the surface region has a depth of less than about 50 nanometers.

9. The method of claim 8, wherein the depth of the surface region is at least about five nanometers.

10. The method of claim 1, wherein the first material comprises a nitride and the second material composition comprises an oxide.

11. The method of claim 1, wherein the first material composition comprises a material selected from the group consisting of vanadium nitride, zirconium nitride, titanium nitride and cerium nitride.

12. The method of claim 11, wherein the second material composition comprises a material selected from the group consisting of vanadium oxide, zirconium oxide, titanium oxide and cerium oxide.

13. The method of claim 1, wherein, prior to exposure to the at least one ion beam, the surface region is noncrystalline.

14. The method of claim 13, wherein, after exposure to the at least one ion beam, the surface region is textured.

15. The method of claim 1, wherein the at least one ion beam comprises two ion beams that impinge on the surface region of the layer at a first angle relative to a perpendicular to the surface of the layer, and the two ion beams are disposed relative to each other at a second angle so that the textured surface region has a crystal plane that is oriented perpendicular to the textured surface.

16. The method of claim 1, further comprising exposing the second material to the reactive species in the absence of the at least one ion beam.

17. The method of claim 16, wherein the second material is exposed to the reactive species in the absence of the at least one ion beam at a temperature greater than room temperature.

18. A method of ion texturing a noncrystalline surface of a layer of a nitride, the method comprising:

exposing a surface region of a layer of the nitride to at least two ion beams in an environment comprising a reactive species to texture the surface region of the layer and

to change the composition of the layer in the surface region to an oxide to form a textured oxide surface.

19. The method of claim 18, wherein the at least two ion beams impinge on the surface region at a first angle relative to a perpendicular to the surface, and the at least two ion beams are disposed relative to each other at a second angle so that a crystal plane of the textured surface region is oriented perpendicular to the textured oxide surface.

20. The method of claim 18, wherein the reactive species comprises oxygen.

21. The method of claim 18, wherein the surface region of the oxide has a depth of less than about 50 nanometers.

22. The method of claim 21, wherein the depth of the surface region of the oxide is at least about five nanometers.

23. The method of claim 18, wherein the nitride is selected from the group consisting of vanadium nitride, zirconium nitride, titanium nitride and cerium nitride.

24. The method of claim 23, wherein the oxide is selected from the group consisting of vanadium oxide, zirconium oxide, titanium oxide and cerium oxide.

25. The method of claim 18, wherein the oxide is selected from the group consisting of vanadium oxide, zirconium oxide, titanium oxide and cerium oxide.

26. The method of claim 18, further comprising exposing the second material to a reactive species in the absence of the at least two ion beams.

27. The method of claim 26, wherein the oxide material is exposed to the reactive species in the absence of the at least two ion beams at a temperature greater than room temperature.